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GROUND-WATER QUALITY NEAR THE WATER TABLE IN SUFFOLK COUNTY, LONG ISLAND, NEW YORK

By

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(in pocket)

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UNITS TO INTERNATIONAL SYSTEM (SI) UNITS

Multiply American unit	by	To obtain metric (SI) units
	Length	
inches (in.)	25.4	millimeters (mm)
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
	Area	
square miles (mi^2)	2.590	square kilometers (km^2)
	Flow	
million gallons per day (Mgal/d)	.04381	cubic meters per second (m^3/s)
degrees Fahrenheit (°F)	5/9 (°F-32)	degrees Celsius (°C)

GROUND-WATER QUALITY NEAR THE WATER TABLE

SUFFOLK COUNTY, LONG ISLAND, NEW YORK

By

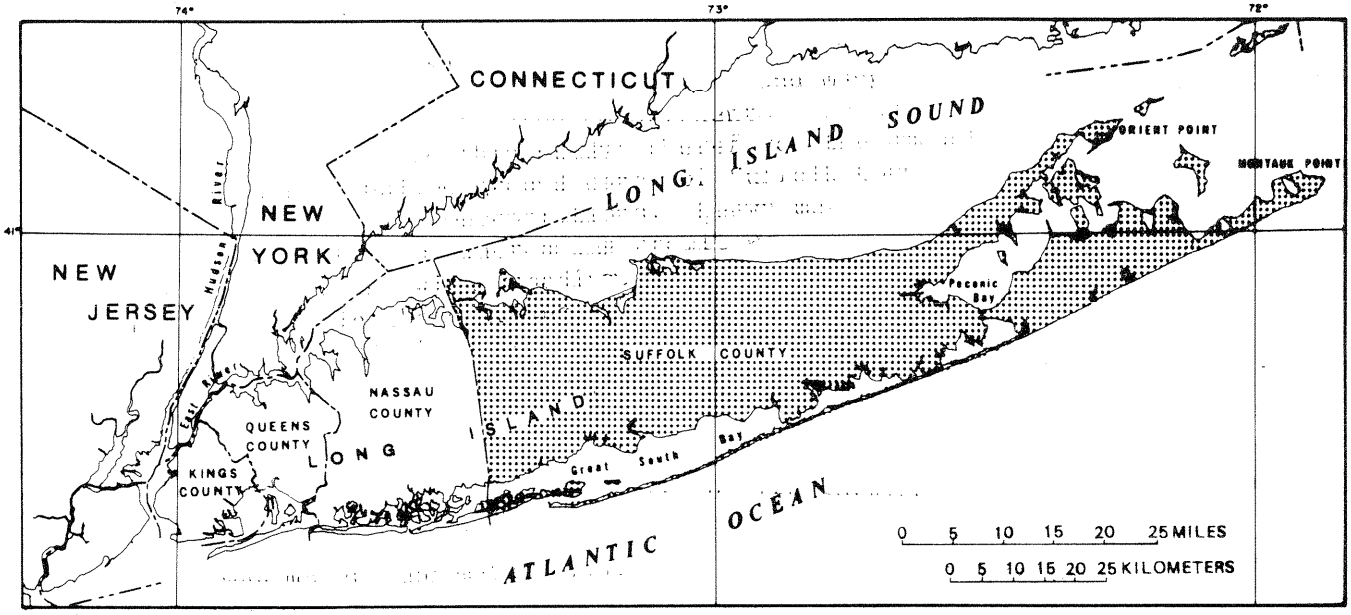
Julian Soren

ABSTRACT

The population of Suffolk County, N.Y., an area of 922 square miles, has increased rapidly since 1940 and is expected to continue to grow. In 1974, the population had reached 1,223,000. Most of the growth has been in the county's western part; the eastern part is largely rural but has many suburban and exurban communities.

Ground water from unconsolidated aquifers is Suffolk County's source of water supply, and further population growth increases the possibility of contamination of the supply. The main sources of ground-water contamination are sewage that enters the ground through cesspools, and leachates from agricultural fertilizers and pesticides. Nitrate nitrogen and methylene-blue active substances, denoting synthetic detergents, are the contaminants of major concern.

From 1972-75, observation wells, screened mostly from 10 to 20 feet below the water table, were installed at 171 sites throughout Suffolk County to (1) obtain base-line data on chemical quality of shallow ground water; (2) delineate areas currently affected by contaminants; and (3) enable future monitoring of ground-water quality. Analyses of water from the observation wells showed that in the more populated, western part of the county, significant contamination of the ground water by nitrate nitrogen had occurred mainly as a result of sewage disposal to the ground, and, in the rural eastern part, mainly from fertilizer leachates. Contamination by synthetic detergents was significant only in a small part of southwestern Suffolk County, probably because a partial ban on synthetic-detergent sales since early 1971 had reduced levels in most places. Virtually no ground-water contamination from pesticides was found in the county during 1972-75. Radioactivity of the shallow ground water did not exceed the probable natural background levels. Analyses for heavy and other metals showed iron and manganese to occur in significant but not injurious concentrations; other metals were found to be below safety limits that have been recommended by agencies of the United States, such as the Public Health Service and Environmental Protection Agency.



Base from U.S. Geological Survey
State base map, 1974

Figure 1.--Location and major geographic features of Suffolk County, Long Island, N.Y.

INTRODUCTION

Suffolk County, in eastern Long Island, N.Y., is about 90 mi long and has a maximum width of about 20 mi (fig. 1). Land area of the county is about 922 mi^2 and constitutes approximately two-thirds of Long Island's 1,411-mi^2 area. From the late 1940's to 1974, population in the county increased from 198,000 to 1,233,000 (I.L. Kundzins, U.S. Department of Commerce, oral commun., Dec. 19, 1975). The growth has occurred mostly in the western part of the county and has been accompanied by an increasing number of commercial, industrial, and service establishments. Before World War II, the county was mostly rural, but by 1975, rural areas were confined mostly to the eastern part.

The increasing population of Suffolk County has given rise to the need to evaluate the chemical quality of ground water because the discharges of additional untreated sewage to the ground through cesspools and other waste-disposal systems must subsequently enter the ground water throughout most of the county. Several small communities, apartment complexes, home developments, institutions, and industries do not use cesspools but discharge treated sewage to tidewater mostly at or near shorelines. Such systems that were operating in Suffolk County in 1975 are listed in table 1; their locations are shown in plate 1B.

Because ground water is the sole source of water supply in the county, its quality is of extreme importance. Ground-water pumpage has increased with the population; pumpage in 1940 was about 40 Mgal/d (Jensen and Soren, 1974, sheet 2) but by 1973 had increased to 178 Mgal/d (R. J. O'Reilly, New York State Dept. Environmental Conserv., oral commun., Jan. 5, 1976.)

Purpose and Scope of Investigation

The U.S. Geological Survey, in cooperation with the Suffolk County Department of Environmental Control, began a reconnaissance program in 1972 to investigate the quality of ground water between 10 and 50 feet below the water table in Suffolk County. The program had two objectives--to document the present chemical quality of shallow ground water for delineation of areas with real or potential problems, and to establish an observation-well network so that future changes in shallow ground-water quality resulting from human or natural causes can be monitored.

The water table in nearly all of Suffolk County is in unconsolidated Pleistocene deposits of the upper glacial aquifer. In a small area of west-central Suffolk County, near the Nassau County boundary, the Pleistocene deposits are unsaturated, and the water table is in the Magothy aquifer. The aquifers and water table in the county have been described by Jensen and Soren (1974).

This investigation was limited to ground water near the water table to delineate areas affected by downward movement of contaminating substances such as sewage, fertilizers, pesticides, and industrial wastes that are introduced at or near land surface. The observation-well network can be used in the future to detect changes in previously unaffected areas and to monitor changes resulting from continued or increased rate of contaminating discharges from various known sources.

Table 1.--Systems in Suffolk County that discharged treated sewage to tidewater in 1975[1/]

System	Township	Discharge area
Harbor Club Apartments, Babylon	Babylon[2/]	Santapogue Creek[3/]
Kings Park State Hospital, Kings Park	Smithtown	Nissequogue River[4/]
Ocean Beach (Village of), Fire Island	Islip	Great South Bay
Port Jefferson (Village of)	Brookhaven	Long Island Sound
Park Avenue Apartments, Babylon	Babylon[2/]	Argyle Creek[3/]
Patchogue (Village of)	do.	Patchogue River[3/]
Brookhaven National Laboratory, Ridge	do.	Peconic River[5/]
Riverhead (Village of)	Riverhead	Do.
Grumman Aerospace Corp., Calverton	do.	Swan Pond[6/]
Greenport (Village of)	Southold	Southold Bay
U.S. Department of Agriculture, Plum Island	do.	Long Island Sound
Shelter Island Heights (community)	Shelter Island	Southold Bay
Southside Hospital, Bay Shore	Islip[2/]	Penataquit Creek[3/]
U.S. Air Force Base, Montauk	East Hampton	Atlantic Ocean
Watergate Apartments, Patchogue	Brookhaven	Patchogue River[3/]

1/ J. H. Baier, Suffolk County Department of Environmental Control, written comm., July 12, 1976.
2/ Southwest Sewer District, which will service the southern parts of Babylon and Islip, is scheduled to be operational in 1978.
3/ Discharges into Great South Bay.
4/ Discharges into Smithtown Bay.
5/ Discharges into Flanders Bay.
6/ Discharges through Peconic River into Flanders Bay.

Ground-water quality was monitored near the water table rather than at depth because changes occur first and most rapidly near the surface. Downward movement of water from the water table into the ground-water reservoir is slow compared to the horizontal movement of water in the aquifer, and a contaminant applied at land surface could take several decades to move to a depth of 100 ft in the upper glacial aquifer under natural gradients (Franke and Cohen, 1973, p. 274-275).

Downward movement of water below the water table is most pronounced at the ground-water divide of the county (Franke and Cohen, 1973, p. 274), which traverses the north-central part of the county and branches into the eastern forks (Jensen and Soren, 1974, sheet 2). North and south of the divide, that is, between the divide and shorelines (Franke and Cohen, 1973, p. 274), downward movement below the water table decreases to zero, but near the shorelines, movement tends to reverse upward (Franke and Cohen, 1973, p. 273). A simplified version of the ground-water flow system is shown in figure 2.

The rate of downward movement of contaminants in the upper glacial aquifer to wells screened in it is greatly increased by intensive pumping in the aquifer; however, the rate of increase may be lessened by pumping from greater depths in the underlying Magothy aquifer because of the Magothy's much lower vertical permeability. In an area where ground water is being developed, the increase in rate of downward movement of a contaminant therefore depends greatly on the distribution and intensity of pumping.

Methods Of Investigation

A network of 193 observation wells screened at shallow depth in the upper glacial aquifer was installed throughout Suffolk County from May 1972 to April 1975 (pl. 1A). The wells are of 4-in. and 6-in. inside diameter (ID); they are generally of 4-in. ID where depths from land surface to the water table were not more than about 20 ft, and of 6-in. ID where the water table was deeper. The wells are finished with 10-ft lengths of stainless-steel screens whose tops were set mostly about 10 ft below the water table. A typical well installation is shown in figure 3. At 22 of the observation-well sites, a second well was installed with the top of the screen set about 40 ft below the water table.

Screen tops were set at about 10 ft below the water table in the shallow wells to allow for water-table decline seasonally and during drought, and for drawdown when pumping the wells for samples. The deeper screen settings are in areas of ground-water discharge near shorelines to monitor movement or dilution of contaminants that enter the ground-water reservoir near the ground-water divide. This monitoring system will permit evaluation of changes in ground-water quality as sewage discharge to the ground water is steadily decreased and sewering is installed. Contaminants in the deeper screened zones will take longer to flush from the reservoir than contaminants near the water table once the areal sanitary-sewer systems that discharge to tidewater have been installed. Such a sewer system is now (1976) under construction in the southern parts of the townships of Babylon and Islip.

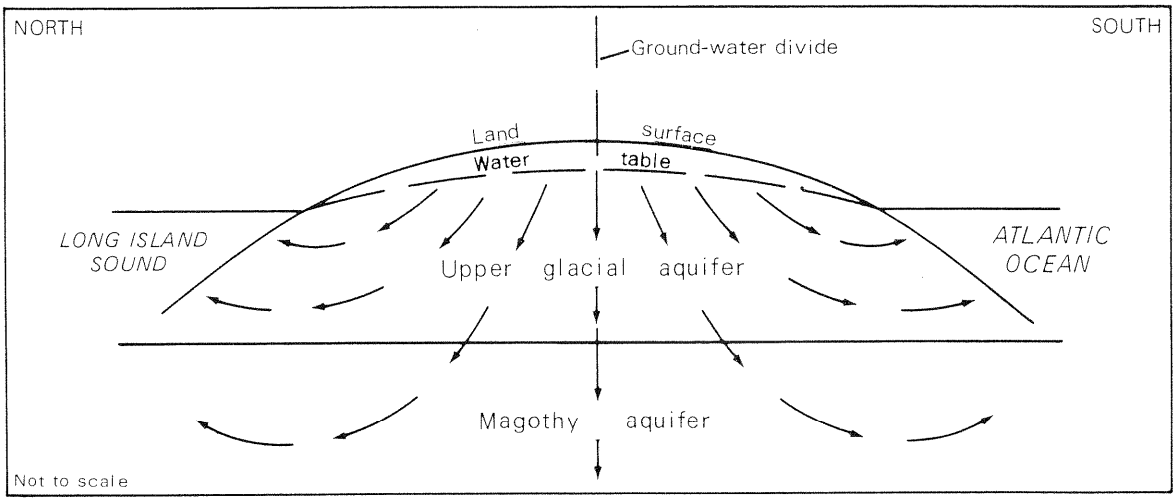


Figure 2.--Generalized hydrogeologic section across Suffolk County, N.Y., showing typical ground-water movement (arrows) under natural hydraulic gradients. (Adapted from Franke and Cohen, 1973, p. 273.)

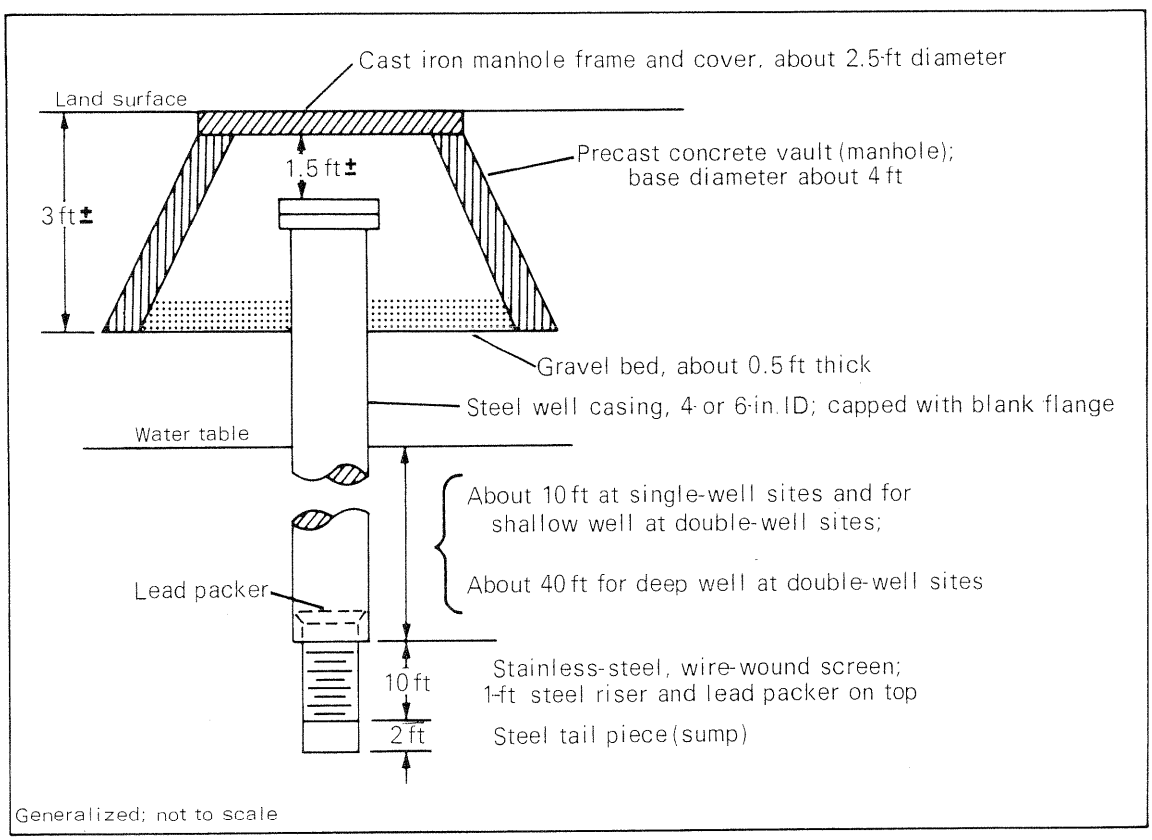


Figure 3.--Typical observation-well installation.

The wells were developed by pumping to obtain maximum yields of apparently clear water and were then pumped to obtain samples of water for laboratory analyses. The water samples were analyzed for general chemical quality, heavy metals, pesticides, and radioactivity. At the time of sampling, field measurements of temperature, specific conductance, pH, and dissolved oxygen were made. Analyses for general chemical quality, pesticides, and radioactivity were performed by the U.S. Geological Survey laboratories in Albany, N.Y., Doraville, Ga., and Denver, Colo., respectively.

Observation-well sites in the 10 towns of Suffolk County were distributed as follows: Huntington, 9; Smithtown, 7; Babylon, 10; Islip, 12; Brookhaven, 30; Riverhead, 28; Southold, 21; Shelter Island 17; Southampton, 23; and East Hampton, 14. Locations of the well sites are shown in plate 1A. Although 193 observation wells were installed at 171 sites, only 187 wells at 164 sites are shown in plate 1A because some of the samples were lost or destroyed in transit to the laboratory. The relatively small number of wells shown in Huntington and Smithtown is due to abandonment of sites because thick deposits of silt and clay from above to below the water table precluded their usefulness for the purposes of the program.

Acknowledgments

The observation wells were installed by the cable-tool (percussion) method under contracts between the Suffolk County Department of Environmental Control and the following well-drilling companies (listed in decreasing order of number of wells installed): East Coast Well Drilling and Supply Co., Inc., Riverhead, N.Y.; The Lauman Co., Inc., Bethpage, N.Y.; Delta Well Co., Inc., Central Islip, N.Y.; and Harold McMahon, Amagansett, N.Y. Field supervision of well installations and collection of water samples were mainly done by James E. Potorti of the U.S. Geological Survey. Additional supervision of well installations and water-sample collections was done by Arthur C. Sorensen and Marilyn Ginsberg of the Suffolk County Department of Environmental Control, and Edward J. Koszalka and Richard J. Reynolds of the U.S. Geological Survey.

Previous Investigations

Several studies have documented specific cases of ground-water contamination in Suffolk County and in nearby Nassau County, which has a similar hydrogeologic setting. In particular, Perlmutter and Guerrera (1970) and Baier (1976) described contamination by synthetic detergents from sewage in the Towns of Babylon and Islip; Perlmutter and Lieber (1970) traced the movement of cadmium and chromium from industrial plating wastes near Suffolk County in adjacent Nassau County; and Ku and Sulam (1976), Perlmutter and Koch (1972), and Smith and Baier (1969) reported on ground-water contamination by nitrates from sewage and fertilizers in Nassau County. Soren (1971, p. 26) cited an example of nitrate contamination from fertilizers in Suffolk County near the Nassau boundary.

CHEMICAL QUALITY OF SHALLOW GROUND WATER

Water from the observation wells was analyzed for nitrate, synthetic detergents, pesticides, many heavy metals (other than iron and manganese), and radioactivity. Analyses for the last three constituents were not ordinarily made on Long Island prior to this study; therefore, the amounts of these substances found in the shallow ground water of Suffolk County represent the earliest known baseline concentrations. Heavy metals discussed in this report include metals of increasing atomic weight in the periodic table of elements, starting with vanadium. Significant findings from the analyses are discussed in the sections that follow, and selected chemical analyses are given in table 2.

Metals

According to standards adopted by the U.S. Public Health Service (referred to as PHS in the chemical-quality section of this report) in 1962 and in subsequent amendments, the metals listed in drinking-water standards are:

aluminum	chromium	lithium	nickel	tin
arsenic	cobalt	manganese	rubidium	vanadium
barium	copper	mercury	silver	zinc
beryllium	iron	molybdenum	strontium	zirconium
cadmium	lead			

In this report, recommended limits for several of these metals are not given because (1) Federal standards for the maximum allowable concentrations in drinking water and (or) culinary water have not been published, and (2) present knowledge of the effects of metals on human physiology is inadequate to establish safety limits. However, results of analyses for metals having unspecified safety limits are included in this report for future comparison, should such need arise.

Metals described herein are separated into two groups. Group 1 includes those for which PHS has established maximum allowable concentrations; group 2, those for which no PHS standards have been established. All metals in group 1 are heavy metals.

The United States Environmental Protection Agency (referred to as EPA in the chemical-quality section of this report) adopted a set of drinking-water standards (1975) to replace PHS standards. These EPA standards (1975a and 1975b) became effective June 24, 1977. Wherever PHS standards are cited in this report, EPA standards follow in parentheses; for example, "PHS, 10 µg/L (EPA, 50 µg/L)." Both PHS and EPA standards are included because of the changing nature of water-quality standards.

TABLE 2

Selected chemical analyses from shallow observation wells

in Suffolk County, N.Y., 1972-75

The following table, in computer-printout form, was obtained through the U.S. Geological Survey's Water Storage and Retrieval (Watstore) data bank and presents water-quality analyses of samples from the following townships:

The following abbreviations and symbols are used in table 2:

No.,	north	E.,	east	PT.,	point
N.,	north	SO.,	south	N.W.,	northwest
W.,	west	STA.,	station	HRBR,	harbor

MG/L, milligrams per liter
DEG C, degrees Celsius,
UG/L, micrograms per liter
FT, feet

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1970-75

(ANALYSES BY U. S. GEOLOGICAL SURVEY)

A. BABYLON TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 43808 NO. AMITYVILLE	54	72-06-27	8.9	120	2200	28	4.5	36	7.7	44
S 43809 COPIAGUE	34	72-06-26	9.9	230	1100	23	3.6	45	6.4	61
S 43810 COPIAGUE	71	72-06-26	9.9	150	260	13	4.5	12	1.8	39
S 43811 PINELAWN	85	72-06-28	8.5	330	0	21	7.3	16	1.1	20
S 43812 LINDENHURST	30	72-06-26	5.2	140	1100	18	3.4	29	4.0	44
S 43813 LINDENHURST	73	72-06-26	11	270	400	16	7.8	40	4.7	49
S 43814 WYANDANCH	45	72-06-27	6.9	130	440	11	2.5	35	4.3	30
S 43815 N. LINDENHURST	30	72-06-23	9.1	110	1500	19	4.4	30	5.6	40
S 43816 N. LINDENHURST	75	72-06-23	9.9	180	500	12	6.2	19	2.8	37
S 43817 WYANDANCH	51	72-07-24	10	30	0	5.0	3.5	12	1.0	2.4
S 43818 W. BABYLON	30	72-07-21	8.5	110	2200	18	4.0	28	6.1	47
S 43819 W. BABYLON	73	72-07-21	11	180	300	11	6.0	21	2.1	29
S 43820 DEER PARK	92	72-07-25	9.0	70	0	2.0	1.3	3.5	.4	1.4
S 43821 NO. BABYLON	31	72-07-20	7.0	460	2200	23	3.8	34	6.6	43
S 43822 NO. BABYLON	69	73-12-10	14	--	--	16	3.5	11	3.5	19

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
72-06-27	46	11	11	.13	.01	245	370	8.1	12.5	1.7	.28
72-06-26	48	15	20	4.6	.01	277	370	3.6	12.0	1.4	.35
72-06-26	13	3.6	3.9	.28	.00	115	155	4.8	12.0	2.4	.12
72-06-28	23	18	--	.09	--	178	235	4.4	12.0	3.3	.14
72-06-26	51	.12	2.4	1.7	.00	166	320	5.9	14.0	1.4	.12
72-06-26	51	10	12	2.3	.00	236	335	4.8	14.0	.7	.64
72-06-27	53	4.9	6.0	1.0	.00	169	225	5.0	12.0	1.6	.09
72-06-23	39	7.8	9.9	2.1	.00	196	342	6.1	11.0	1.7	.14
72-06-23	21	8.4	9.3	.58	.00	151	190	5.6	12.0	1.4	.13
72-07-24	24	3.2	3.3	.05	.00	77	215	5.0	12.0	8.7	.03
72-07-21	31	7.4	12	4.1	.00	196	355	4.5	12.5	--	.20
72-07-21	22	7.2	7.7	.50	.00	142	241	4.5	12.3	--	.34
72-07-25	5.0	.99	1.2	.10	.00	31	37	4.2	11.0	9.1	.04
72-07-20	41	4.2	10	5.5	.01	217	418	6.8	--	--	.31
73-12-10	15	2.0	2.3	.21	.01	110	200	5.7	12.0	2.0	--

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1972-75 (CONTINUED)

B. BROOKHAVEN TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 46911 MORICHES	31	73-03-20	5.3	100	480	7.3	1.3	40	1.8	18
S 46912 MORICHES	21	73-03-19	2.2	130	0	--	.2	2.7	6.0	2.5
S 46913 MORICHES	19	73-03-19	1.8	110	10	2.0	.4	31	1.4	6.5
S 46914 MORICHES	33	73-03-21	2.6	40	0	--	.2	6.6	.5	9.0
S 46966 CENTER MORICHES	82	73-01-26	7.0	40	0	2.0	1.1	3.9	.3	6.0
S 47224 SO. HAVEN	33	73-04-05	6.8	60	70	3.5	1.8	4.0	.7	8.0
S 47225 YAPHANK	30	73-04-03	8.7	100	30	34	7.5	4.2	5.2	67
S 47675 LAKE GROVE	87	73-04-12	6.8	120	40	14	2.9	16	2.1	33
S 47698 SO. SETAUKET	114	73-05-07	9.5	30	0	3.4	.9	3.2	.4	4.6
S 47718 LAKE RONKONKOMA	51	73-05-11	2.8	1400	340	11	3.6	13	2.7	21
S 47743 PATCHOGUE	100	73-05-31	17	310	110	6.8	1.9	4.3	.5	2.8
S 47745 MIDDLE ISLAND	32	73-07-06	7.6	70	40	7.9	3.0	9.3	.9	12
S 47746 YAPHANK	84	73-06-13	6.9	180	0	3.5	1.2	3.7	1.7	9.7
S 47747 BROOKHAVEN	32	73-06-28	6.7	94	30	2.6	1.7	7.5	1.1	7.7
S 47748 EAST SHORHAM	115	73-07-09	7.1	50	10	1.3	1.2	4.5	.5	4.3
S 47749 RIDGE	32	73-05-02	10	90	200	18	7.3	40	1.2	12
S 47750 SO. MANOR	95	73-07-13	12	40	0	2.7	1.2	4.4	.3	4.0
S 47751 E. PATCHOGUE	38	73-05-22	9.0	40	2500	18	3.0	18	4.6	30
S 47752 E. PATCHOGUE	100	73-05-18	18	40	0	10	2.9	4.2	.4	2.0
S 47753 CALVERTON	100	73-07-30	9.0	40	50	3.9	1.5	4.3	.6	5.7
S 47754 CALVERTON	39	73-07-30	4.9	70	110	2.1	1.1	4.1	.4	6.0
S 47755 SO. HAVEN	58	73-06-13	14	590	20	3.9	1.6	6.5	1.2	7.2
S 47756 MEDFORD	69	73-06-15	8.4	160	0	7.0	2.9	14	1.2	12
S 47757 FARMINGVILLE	138	73-06-22	14	85	10	7.2	2.0	4.2	.4	12
S 47758 RONKONKOMA	102	73-06-28	10	120	0	4.6	2.9	13	.9	8.6
S 47945 ROCKY POINT	142	73-05-02	8.5	90	0	7.3	1.8	4.7	.6	16
S 47973 SETAUKET	90	73-06-20	12	180	0	60	14	16	2.3	140
S 47974 PT. JEFFERSON ST	149	73-05-25	12	110	40	8.8	4.1	17	1.3	12
S 47975 CORAM HILL	129	73-06-08	16	170	0	12	3.8	4.8	.7	9.6
S 47976 MILLER PLACE	138	73-05-17	13	70	80	17	4.9	21	1.0	7.5
S 47977 MASTIC	55	73-07-18	8.3	110	160	7.0	2.4	11	2.6	11
S 48651 CENTEREACH	63	73-07-12	11	40	20	12	3.5	34	1.7	13
S 48759 PATCHOGUE	33	73-06-26	7.1	200	20	16	2.0	19	2.8	19
S 48946 SO. MANOR	41	73-07-24	10	10	40	34	6.2	9.8	3.2	22
S 48958 NO. SELDEN	81	73-07-27	10	70	20	2.7	1.1	3.9	.4	3.4

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED-SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
73-03-20	53	1.5	1.6	.02	.01	139	260	6.0	10.5	4.5	.03
73-03-19	2.8	.20	.27	.03	.00	--	16	6.5	7.0	4.9	.00
73-03-19	30	.40	.67	.04	.07	89	205	7.3	6.0	4.5	.02
73-03-21	2.5	.40	.49	.02	.00	--	28	6.8	9.5	4.7	.00
73-01-26	4.5	.00	.26	.00	.00	28	40	6.7	11.3	--	.00
73-04-05	7.0	.09	.21	.00	.04	35	70	5.7	9.0	1.3	.01
73-04-03	11	12	12	.02	.00	195	325	6.0	9.5	5.0	.02
73-04-12	21	2.5	2.7	.05	.00	116	190	6.1	--	--	.04
73-05-07	4.5	.01	.06	.00	.00	30	28	6.1	10.5	6.5	.00
73-05-11	16	2.5	2.8	.04	.01	89	170	5.6	12.0	1.2	.14
73-05-31	4.8	.03	1.0	.06	.02	55	59	6.8	12.5	2.0	.00
73-07-06	12	4.7	4.8	.04	--	78	155	5.8	10.5	4.1	.01
73-06-13	4.8	.18	.24	.04	.00	34	51	6.1	11.0	6.5	.01
73-06-28	13	.28	.32	.03	.00	44	68	5.7	11.0	3.9	.01
73-07-09	6.5	.15	.22	.03	--	29	35	6.1	11.0	5.2	.02
73-05-02	98	2.9	3.1	.15	.00	204	425	6.2	12.0	5.4	.05
73-07-13	5.5	.02	.04	.00	--	35	39	6.1	10.5	9.4	.00
73-05-22	20	10	10.4	.42	.00	151	280	5.5	11.0	1.4	.18
73-05-18	4.1	.02	.09	.06	.03	60	57	7.2	11.5	2.0	.09
73-07-30	7.4	.02	.05	.02	.01	39	45	6.7	11.0	8.3	.00
73-07-30	6.5	.04	.08	.00	.00	28	39	5.6	10.5	8.8	.00
73-06-13	9.0	.07	.13	.02	.01	50	66	6.4	11.5	2.5	.00
73-06-15	25	.90	1.1	.02	.00	80	189	6.1	11.5	6.3	.03
73-06-22	5.5	.57	.63	.04	.01	56	174	6.5	11.5	6.4	.02
73-06-28	23	1.6	1.6	.03	.00	76	161	6.2	12.0	5.4	.00
73-05-02	7.1	.20	.26	.01	.00	51	63	6.4	11.0	6.8	.01
73-06-20	25	10.0	10.1	.05	.01	323	580	6.3	11.5	5.4	.10
73-05-25	22	4.3	4.9	.09	.01	106	185	5.8	11.5	6.3	.07
73-06-08	7.2	.06	.27	.03	.01	76	151	7.1	11.5	7.1	.00
73-05-17	45	1.1	1.2	.07	.01	132	250	6.6	10.5	6.4	.06
73-07-18	16	4.3	4.4	.01	--	79	178	5.1	11.5	7.3	.00
73-07-12	50	3.4	3.4	.00	--	149	325	6.2	12.5	4.0	.00
73-06-26	24	7.7	7.9	.15	.00	131	258	6.0	12.0	20.0	.02
73-07-24	25	6.8	6.9	.05	--	144	350	5.6	10.5	8.3	.01
73-07-27	5.8	.05	.09	.03	--	32	37	6.3	11.0	9.1	.00

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1972-75 (CONTINUED)

C. EAST HAMPTON TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 47235 N.W. HARBOR PARK	22	73-03-20	13	2700	250	4.4	5.3	41	2.6	17
S 47236 CEDAR PT. PARK	57	73-03-15	12	50	0	3.5	2.1	12	.6	8.9
S 48429 E. HAMPTON	62	73-08-07	7.6	140	60	53	7.0	8.6	.8	110
S 48517 WAINSCOTT	71	73-08-03	12	--	--	2.9	1.3	5.9	.6	4.5
S 48518 WAINSCOTT	50	73-08-01	7.4	90	10	2.7	1.3	6.2	1.0	5.5
S 48519 MONTAUK	82	73-09-30	22	90	40	8.0	5.2	20	1.9	11
S 48520 HARDSCRABBLE	59	73-08-06	11	80	70	4.9	2.7	11	6.5	13
S 48521 SAG HARBOR	75	73-08-06	11	50	20	2.6	1.5	7.1	.6	7.4
S 48522 AMAGANSETT	88	73-09-17	9.7	130	40	4.7	4.5	17	1.3	11
S 48577 MONTAUK	186	73-09-18	16	130	60	3.6	2.7	12	1.0	5.9
S 48578 THREE MILE HRBR	29	73-08-07	12	100	60	8.4	2.4	40	3.1	9.9
S 48579 MONTAUK	66	73-10-11	14	150	110	7.5	5.5	23	2.7	10
S 48580 THREE MILE HRBR	46	73-09-14	11	160	110	4.9	3.5	12	.4	10
S 49898 W. AMAGANSETT	64	73-10-10	7.1	90	50	1.7	1.9	8.0	1.1	5.3

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
73-03-20	55	.00	.31	.21	.00	154	278	6.7	10.0	2.5	--	.02
73-03-15	16	.02	.45	.01	.00	62	97	6.7	10.0	5.8	--	.02
73-08-07	15	6.5	6.6	.01	--	241	392	6.1	11.0	7.3	--	.01
73-08-03	9.0	.02	--	.16	--	42	60	6.5	11.0	9.2	--	.01
73-08-01	11	.06	.10	.02	--	38	52	5.9	10.5	8.9	--	.00
73-09-30	28	2.6	2.6	.01	--	113	197	6.6	12.0	--	--	.02
73-08-06	18	2.8	2.8	.01	--	84	150	5.9	10.5	9.3	--	.00
73-08-06	9.5	.25	.38	.01	--	47	55	6.5	10.5	8.8	--	.00
73-09-17	33	.22	.25	.03	--	88	195	6.1	11.0	--	--	.01
73-09-18	18	.71	.74	.03	--	72	130	6.6	11.0	--	--	.02
73-08-07	31	15	16	.33	--	184	277	6.1	--	--	--	.06
73-10-11	44	1.2	1.2	.04	--	119	221	6.3	12.0	--	--	.01
73-09-14	11	2.0	2.0	.01	--	72	133	5.8	11.0	7.0	--	.05
73-10-10	13	.11	.16	.11	--	42	74	6.0	11.5	--	--	.02

D. HUNTINGTON TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 44914 CENTERPORT	22	73-01-24	10	70	20	9.9	2.6	11	2.1	16
S 45053 HALESITE	114	72-12-15	17	80	20	17	6.5	11	1.5	20
S 45207 COMMACK	142	73-01-15	13	130	40	21	6.8	9.1	1.3	33
S 45208 HUNTINGTON STA.	133	73-01-19	13	150	190	44	14	40	3.5	70
S 45210 COMMACK	107	72-10-27	13	80	0	26	7.8	11	1.1	57
S 45212 NORTHPORT	111	72-11-01	14	50	0	16	6.4	15	1.6	25
S 46281 HUNTINGTON STA.	47	73-01-02	19	50	0	17	6.1	10	1.3	18
S 46283 DIX HILLS	235	73-02-13	7.0	90	10	3.5	1.0	4.5	.5	.0
S 46962 CENTERPORT	62	73-01-30	15	110	40	9.0	3.5	7.5	1.0	11
S 47220 MELVILLE	92	73-03-14	5.4	30	0	.4	.4	3.6	.3	.0

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
73-01-24	14	3.3	3.4	.00	.01	86	135	6.7	9.5	--	--	.03
72-12-15	16	6.5	6.5	.00	.01	132	201	7.3	11.5	--	--	.05
73-01-15	13	7.6	7.7	.01	.00	142	218	7.0	11.5	--	--	.06
73-01-19	32	34	34.3	.02	.03	381	540	7.3	13.0	--	--	.24
72-10-27	15	7.1	7.1	.00	.01	168	240	5.7	13.3	7.8	--	.07
72-11-01	18	8.1	8.1	.00	.02	141	220	6.0	11.1	7.3	--	.07
73-01-02	10	5.7	5.8	.02	.02	128	190	8.2	15.0	--	--	.03
73-02-13	6.1	2.9	3.0	.01	.00	41	60	6.2	11.0	--	--	.01
73-01-30	9.5	2.7	2.8	.01	.02	80	130	6.8	12.3	--	--	.02
73-03-14	5.5	50	62	.02	.02	21	68	6.5	10.0	5.8	--	.03

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1972-75 (CONTINUED)

E. ISLIP TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 44918 HOLBROOK	82	72-10-24	8.3	90	40	3.8	1.7	6.0	.7	5.7
S 45446 BAY SHORE	38	72-12-01	13	90	1500	21	4.0	26	7.8	36
S 45447 BOHEMIA	79	72-12-27	9.2	80	30	10	2.7	15	2.3	15
S 45636 OAKDALE	26	72-11-22	12	300	0	6.0	2.5	3.4	5	2.5
S 45637 OAKDALE	79	72-11-20	7.9	80	30	4.9	1.4	7.8	1.6	10
S 45717 BRENTWOOD	73	72-10-30	6.9	40	0	2.9	1.7	3.1	.2	7.0
S 45718 CENTRAL ISLIP	24	72-11-14	10	100	90	12	3.8	13	6.2	23
S 45719 CENTRAL ISLIP	78	72-11-10	15	70	0	6.3	2.0	5.4	.5	3.6
S 45720 BRENTWOOD	78	72-12-06	10	50	50	5.8	4.0	11	1.0	14
S 45721 ISLIP	34	72-11-06	8.2	60	50	13	2.8	38	2.4	18
S 45722 ISLIP	87	72-11-02	12	120	0	8.8	5.0	11	.8	4.2
S 46284 LAKELAND	104	72-12-20	13	80	0	8.9	3.4	20	2.3	16
S 46286 HAUPPAUGE	103	72-12-12	14	50	0	5.5	1.7	5.8	1.2	9.8
S 46287 BAY SHORE	85	72-11-29	12	150	30	8.0	3.6	12	.7	.1
S 46502 BOHEMIA	40	72-12-29	7.2	60	0	21	3.2	43	5.5	33
S 47222 W. BAY SHORE	24	73-04-13	11	70	160	6.8	1.8	10	1.6	9.5
S 47223 W. SAYVILLE	26	73-04-12	9.0	50	70	19	3.0	10	1.6	34

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
72-10-24	8.3	1.8	1.9	.07	.00	46	70	6.1	13.0	8.0	--	.04
72-12-01	38	15	16	.92	.00	214	350	4.1	14.5	1.6	--	.27
72-12-27	21	4.7	4.7	.00	.00	100	190	6.8	10.0	--	--	.04
72-11-22	3.6	.02	.41	.10	.03	45	100	3.5	11.5	5.5	--	.01
72-11-20	10	2.3	2.9	.12	.00	57	75	6.7	10.5	6.3	--	.03
72-10-30	4.9	.09	.16	.00	.00	30	55	6.5	10.6	8.2	--	.02
72-11-14	14	8.6	8.6	.01	.00	123	205	3.9	11.5	5.3	--	.07
72-11-10	6.4	1.9	1.9	.01	.00	57	91	7.0	11.0	6.1	--	.02
72-12-06	13	5.3	5.4	.00	.00	87	150	4.4	11.5	7.3	--	.04
72-11-06	61	2.9	3.0	.10	.00	162	320	6.2	11.0	3.4	--	.05
72-11-02	16	6.2	6.3	.06	.01	95	170	6.1	11.0	2.0	--	.21
72-12-20	18	6.7	6.7	.00	.00	118	178	7.0	11.5	--	--	.06
72-12-12	8.3	.09	.21	.05	.00	55	93	5.3	10.5	9.3	--	.01
72-11-29	12	8.4	8.5	.06	.00	92	145	4.3	12.0	3.6	--	.15
72-12-29	66	1.7	1.7	.00	.04	199	380	7.0	--	--	--	.04
73-04-13	13	.30	1.5	1.1	.00	70	116	7.5	--	--	--	.06
73-04-12	16	3.1	3.2	.03	.00	114	185	7.1	--	--	--	.05

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1972-75 (CONTINUED)

F. RIVERHEAD TOWNSHIP

LOCAL IDENTIFIER		TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 47226	PECONIC PARK	27	73-03-30	11	12000	200	11	1.5	5.2	.5	2.5
S 47227	PECONIC PARK	97	73-03-29	15	920	220	13	2.0	4.2	.3	3.0
S 47228	CALVERTON	101	73-03-27	13	9000	200	--	.3	6.8	1.1	8.0
S 47229	CALVERTON	25	73-03-27	7.8	650	70	4.2	1.0	12	1.5	15
S 47231	AQUEBOGUE	39	73-03-30	7.9	60	40	4.6	2.0	6.7	.9	12
S 51566	CENTERVILLE	87	74-07-23	9.7	90	90	100	18	8.2	4.5	240
S 51567	CENTERVILLE	92	74-06-10	9.4	70	70	80	11	10	3.0	180
S 51568	NORTHVILLE	68	74-08-11	8.3	150	20	47	6.1	20	5.1	100
S 51571	CENTERVILLE	106	74-06-28	9.3	20	20	55	12	14	2.5	140
S 51573	RIVERHEAD	88	74-07-09	40	70	60	19	2.4	6.4	.8	.5
S 51575	RIVERHEAD	32	74-08-07	5.6	2100	90	3.0	1.6	6.1	1.1	8.7
S 51576	RIVERHEAD	67	74-07-12	7.7	10	100	23	6.3	8.0	2.9	54
S 51577	BAITING HOLLOW	93	74-07-09	8.1	50	230	62	11	10	7.2	160
S 51578	BAITING HOLLOW	127	74-06-24	8.6	20	20	30	9.8	8.2	2.8	76
S 51579	CALVERTON	85	74-06-25	8.7	0	0	8.4	3.6	5.9	1.4	30
S 51580	WADING RIVER	137	74-06-20	7.2	20	20	16	4.6	6.7	2.8	36
S 51581	JAMESPORT	43	74-07-30	7.5	60	40	85	14	15	3.6	180
S 51582	NORTHVILLE	82	74-07-25	9.5	0	0	82	12	14	5.5	170
S 51583	WADING RIVER	49	74-08-04	6.4	0	0	2.1	2.4	7.4	.9	7.7
S 51584	WADING RIVER	140	74-09-10	15	140	50	8.4	3.4	8.5	.9	15
S 51586	WADING RIVER	99	74-08-05	7.5	120	60	15	11	6.0	1.3	45
S 51587	NORTHVILLE	78	74-07-26	8.5	40	40	28	5.4	9.2	9.6	55
S 51588	AQUEBOGUE	58	74-07-31	7.2	50	0	78	11	9.8	3.4	160
S 51589	JAMESPORT	41	74-07-15	6.9	0	200	11	2.0	7.5	4.0	26
S 51591	CALVERTON	28	74-05-30	5.0	1400	90	--	--	--	--	13
S 51592	WADING RIVER	39	74-07-18	6.5	130	10	4.5	1.6	9.5	1.0	13
S 51828	ROANOKE	149	74-06-17	9.8	70	0	28	9.8	9.4	2.0	77
S 52383	CALVERTON	61	74-06-28	4.5	0	170	11	1.7	5.5	5.7	20
S 52449	RIVERHEAD	38	74-07-10	12	20	0	14	3.8	34	1.8	31
S 52886	WADING RIVER	66	74-09-12	9.5	70	50	17	3.8	8.5	.8	33

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
73-03-30	8.0	.20	1.6	1.1	.18	64	96	7.0	10.0	2.6	--	.04
73-03-29	5.0	.05	.21	.13	.23	67	72	7.3	9.5	.6	--	.00
73-03-27	7.5	.00	.09	.07	.09	--	51	6.0	10.0	.4	--	.00
73-03-27	13	1.0	1.2	.05	.01	62	78	6.0	10.5	2.4	--	.02
73-03-30	11	1.8	1.9	.03	.00	55	64	5.2	10.5	2.8	--	.03
74-07-23	43	18	18.1	.04	--	441	>1000	5.6	11.0	9.0	1.8	.15
74-06-10	35	9.4	10.1	.01	.01	374	615	5.3	11.0	--	.2	.10
74-08-11	40	9.4	9.5	.00	--	273	525	5.9	12.0	9.1	3.0	.10
74-06-28	29	9.9	10	.00	--	265	670	5.9	11.0	7.8	3.3	--
74-07-09	5.8	.00	--	--	--	114	180	7.8	13.5	1.3	1.6	.01
74-08-07	7.0	.02	.30	.37	--	41	90	6.5	13.0	.7	--	.03
74-07-12	16	9.8	9.9	.00	--	163	320	5.3	11.0	3.8	.3	.05
74-07-09	23	10	10.1	.03	--	332	620	5.3	11.0	8.1	.4	.09
74-06-24	18	7.2	6.9	.01	.01	187	310	5.4	10.0	--	--	.10
74-06-25	7.6	1.2	1.3	.00	--	74	155	5.8	11.0	6.7	1.2	.04
74-06-20	13	4.8	--	--	.01	109	250	5.8	10.0	--	.3	.07
74-07-30	38	13	13.2	.02	--	403	900	5.6	11.0	9.0	.5	.13
74-07-25	25	16	16.1	.01	--	321	1000	5.8	11.0	9.2	.5	.14
74-08-04	13	.19	.26	.00	--	41	85	5.8	10.5	8.7	2.1	.01
74-09-10	11	1.3	1.3	.01	--	71	120	6.2	10.5	9.2	4.0	.02
74-08-05	19	6.1	6.2	.05	--	106	250	5.4	10.5	9.4	2.6	.07
74-07-26	20	10	10.1	.01	--	139	315	5.6	11.0	8.2	.5	.10
74-07-31	32	11	11.1	.01	--	354	850	5.7	11.0	9.1	14	.13
74-07-15	11	4.4	4.5	.01	--	71	210	5.2	11.0	4.7	1.5	.05
74-05-30	5.6	.19	.62	.33	.01	--	100	5.8	10.5	--	--	.04
74-07-18	14	.45	.48	.01	--	51	135	5.6	11.0	8.1	.3	.03
74-06-17	17	6.4	6.5	.02	.02	188	315	6.3	11.0	--	.5	.08
74-06-28	7.5	4.7	4.8	.02	--	77	185	4.8	10.5	7.1	1.0	.08
74-07-10	18	2.8	--	--	--	139	245	6.2	13.5	3.2	2.2	.05
74-09-12	16	4.0	4.1	.04	--	93	195	6.0	11.5	6.4	4.5	.05

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1972-75 (CONTINUED)

G. SHELTER ISLAND TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 51169 SHELTER ISLAND	54	74-03-07	13	60	40	12	7.0	8.0	.9	33
S 51170 SHELTER ISLAND	30	74-02-28	11	70	20	3.0	2.0	11	.7	5.0
S 51171 SHELTER ISLAND	55	74-03-08	14	160	30	12	5.2	12	4.4	21
S 51173 SHELTER ISLAND	50	74-04-23	11	170	150	8.5	4.8	15	4.4	18
S 51174 SHELTER ISLAND	62	74-03-08	12	120	40	10	4.5	15	1.2	21
S 51175 SHELTER ISLAND	60	74-03-06	14	90	0	9.0	4.2	13	1.3	17
S 51177 SHELTER ISLAND	39	74-02-28	11	120	60	5.6	2.0	9.0	1.0	8.0
S 51178 SHELTER ISLAND	45	74-06-12	20	310	40	--	--	--	--	24
S 51179 SHELTER ISLAND	58	74-04-23	14	290	70	16	11	11	1.4	65
S 51180 SHELTER ISLAND	51	74-03-04	15	160	10	7.0	4.3	11	1.2	7.7
S 51181 SHELTER ISLAND	74	74-03-01	10	100	10	23	13	11	.4	58
S 51182 SHELTER ISLAND	76	74-02-28	11	70	30	1.7	2.3	7.0	.7	8.5
S 51183 SHELTER ISLAND	51	74-03-12	12	50	30	5.5	3.0	8.5	.8	5.9
S 52050 SHELTER ISLAND	62	74-06-13	11	380	130	--	--	--	--	17
S 52084 SHELTER ISLAND	73	74-06-11	15	140	50	--	--	--	--	17

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
74-03-07	10	1.9	2.0	.01	--	93	161	6.0	11.0	--	--	.00
74-02-28	22	.28	1.8	.05	--	59	108	5.9	12.5	4.8	--	.00
74-03-08	22	5.8	5.9	.01	--	98	197	5.9	11.5	8.6	--	.00
74-04-23	22	1.7	1.7	.08	--	95	171	6.7	13.5	--	--	.03
74-03-08	23	2.4	2.5	.02	--	96	185	6.0	12.5	8.0	--	.00
74-03-06	19	3.1	3.2	.07	--	86	171	6.0	11.0	9.5	.0	.00
74-02-28	13	.53	.55	.04	--	60	111	5.7	11.5	4.3	--	.01
74-06-12	14	--	--	--	--	--	200	--	12.0	5.9	--	.00
74-04-23	11	.29	.30	.08	--	137	217	6.7	12.5	--	--	.01
74-03-04	16	1.4	1.5	.04	--	78	146	6.0	11.0	8.5	.5	.00
74-03-01	22	11.	11	.06	.00	144	325	6.0	11.0	--	--	.02
74-02-28	10	.29	.33	.03	--	46	80	6.0	10.5	9.3	--	.01
74-03-12	13	1.2	1.2	0.	--	60	101	6.1	10.5	8.5	--	.00
74-06-13	20	--	--	--	--	--	320	5.7	13.0	5.9	1.2	.10
74-06-11	14	--	--	--	--	--	160	6.1	11.5	8.8	.3	.01

H. SMITHTOWN TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 45402 KINGS PARK	170	72-10-16	12	220	0	14	4.8	7.8	1.0	23
S 45594 COMMACK	78	72-10-25	11	80	20	15	6.0	5.2	.8	41
S 46963 ST. JAMES	128	73-03-08	12	30	20	3.0	1.4	6.1	.4	3.0
S 46964 KINGS PARK	101	73-03-01	7.5	50	10	2.0	.9	10	.6	.0
S 46965 KINGS PARK	147	73-02-23	13	160	60	14	5.5	16	1.1	6.6
S 47157 HAUPPAUGE	23	73-02-15	9.4	18000	4500	69	21	600	6.9	37

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY
MULTIPLE STATION LISTING

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
72-10-16	10	6.2	6.6	.44	.00	106	195	4.3	11.0	10.0	--	.06
72-10-25	9.8	2.7	3.0	.17	.00	105	180	4.9	10.0	10.4	--	.04
73-03-08	5.0	1.8	1.8	.04	--	43	70	6.6	--	--	--	.03
73-03-01	16	.80	93	.02	.00	45	80	5.4	11.0	6.3	--	.00
73-02-23	48	1.9	2.1	.03	.01	120	225	6.0	10.5	6.8	--	.01
73-02-15	1000	4.0	11	4.2	.02	1800	3400	5.9	12.0	5.4	--	.18

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1972-75 (CONTINUED)

I. SOUTHAMPTON TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 47230 RIVERSIDE	31	73-03-28	6.1	40	220	2.0	1.1	6.7	.4	10
S 47232 SO. FLANDERS	56	73-03-26	10	4900	120	4.2	1.3	5.7	.3	4.0
S 48425 DEERFIELD	41	73-07-31	8.0	80	50	52	7.6	7.8	3.3	120
S 48426 BRIDGEHAMPTON	121	73-09-05	15	90	50	22	7.1	12	.5	52
S 48427 BRIDGEHAMPTON	49	74-05-20	9.7	340	20	--	--	--	--	46
S 48428 WAINSCOTT	71	73-09-06	8.0	10	0	1.5	1.5	6.3	.6	5.0
S 48430 WATER MILL	39	73-08-08	6.8	50	10	1.3	1.7	6.3	1.4	7.1
S 48432 NO. SEA	63	74-05-15	8.5	210	20	--	--	--	--	6.2
S 48433 DEERFIELD	135	73-08-23	9.2	0	10	2.7	1.7	5.6	.5	5.5
S 48434 OAKVILLE	187	73-10-14	7.1	90	10	4.3	2.5	10	.7	5.5
S 48435 E. QUOGUE	56	73-10-02	7.2	0	130	10	2.4	28	5.1	20
S 48436 SPEONK	105	73-10-15	6.1	60	30	1.5	1.7	4.0	.3	4.9
S 48437 SAG HARBOR	69	74-04-09	11	540	30	2.0	1.4	5.7	.5	5.5
S 48438 NOYACK	78	73-09-04	11	90	40	3.5	1.5	10	.7	10
S 48439 SHINNECOCK HILLS	49	73-09-26	8.1	40	40	10	3.8	32	1.7	10
S 48440 SHINNECOCK HILLS	98	73-09-26	14	16	0	3.5	1.8	6.7	.6	5.8
S 48441 HAMPTON PARK	61	73-10-01	9.1	0	20	31	6.0	13	1.3	74
S 48442 SPEONK	55	73-10-10	5.4	60	80	2.2	1.3	14	1.0	5.5
S 48581 HAMPTON BAYS	76	73-10-01	8.1	0	10	2.0	1.3	4.3	.5	5.0
S 48582 OAKVILLE	105	73-10-02	7.8	80	40	2.0	1.8	4.2	.6	5.2
S 48583 WESTHAMPTON	139	73-10-03	7.1	150	50	1.5	.9	4.0	.2	3.6
S 48584 WESTHAMPTON	89	73-10-03	6.4	100	80	1.2	1.3	4.3	.7	4.4
S 51184 NO. HAVEN	32	74-03-01	9.1	300	260	11	17	170	4.2	49
S 51185 NO. HAVEN	31	74-03-01	9.1	40	30	2.4	2.7	9.0	.7	10
S 51186 NO. HAVEN	39	74-03-04	9.4	70	20	8.0	4.5	16	1.0	17

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
73-03-28	9.0	.80	.91	.01	.00	40	54	5.2	10.0	1.6	--	.02
73-03-26	10	.00	.93	.39	.04	43	59	6.3	11.0	.7	--	.00
73-07-31	21	5.4	5.5	.01	--	250	343	6.0	11.5	7.5	--	.00
73-09-05	17	3.8	3.9	.02	--	154	175	6.3	10.5	10.0	--	.01
74-05-20	29	6.2	6.3	.01	.01	--	280	5.5	12.0	--	--	.10
73-09-06	10	.05	.15	.08	--	35	46	6.0	10.5	9.9	--	.02
73-08-08	11	.04	.08	.01	--	38	63	5.9	--	--	--	.01
74-05-15	11	.04	.12	.00	.01	--	78	6.1	12.0	--	--	.00
73-08-23	9.0	.06	.11	.00	--	39	44	6.4	10.5	9.8	--	.00
73-10-14	18	.36	.41	.01	--	55	255	6.7	10.0	8.8	--	.02
73-10-02	50	3.5	3.5	.00	--	125	265	5.2	12.0	--	--	.01
73-10-15	7.0	.01	.02	.01	--	28	195	6.2	10.0	8.8	--	.01
74-04-09	8.1	.00	.04	.03	01	38	60	6.0	10.0	--	--	.00
73-09-04	12	1.1	1.2	.05	--	58	60	5.9	9.5	10.0	--	.02
73-09-26	60	1.0	1.1	.01	--	136	270	6.2	12.5	6.9	--	.00
73-09-26	9.2	.28	.29	.00	--	50	63	6.9	12.0	7.5	--	.00
73-10-01	25	6.1	6.2	0.	--	163	316	6.0	12.0	--	--	.01
73-10-10	23	.12	.13	0.	--	55	80	5.8	11.0	--	--	.01
73-10-01	10	.09	.11	0.	--	34	45	6.2	11.0	--	--	.01
73-10-02	11	.05	.06	0.	--	36	48	6.2	10.0	--	--	.00
73-10-03	6.4	.01	.12	0.	--	26	30	6.4	10.0	--	--	.01
73-10-03	8.5	.06	.07	.04	--	28	47	6.3	10.5	--	--	.01
74-03-01	300	2.0	2.1	.01	--	566	1130	5.4	12.0	4.8	--	.02
74-03-01	15	.18	.21	.03	--	53	100	5.6	11.5	6.5	--	.02
74-03-04	28	3.7	4.2	0.	--	88	185	5.6	11.0	--	.0	.02

TABLE 2.--SELECTED CHEMICAL ANALYSES FROM SHALLOW OBSERVATION WELLS IN SUFFOLK COUNTY, N. Y., 1972-75 (CONTINUED)

J. SOUTHOLD TOWNSHIP

LOCAL IDENTIFIER	TOTAL DEPTH OF WELL (FT)	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)	SULFATE (SO4) (MG/L)
S 47233 SOUTHOLD	51	73-04-10	15	160	0	20	13	15	1.2	68
S 47234 CEDAR BEACH	27	73-04-04	5.4	6000	360	22	44	330	13	120
S 53322 E. MATTITUCK	99	74-11-06	11	50	20	28	11	13	1.2	77
S 53323 STIRLING	50	74-11-27	13	140	30	23	6.2	23	2.2	42
S 53324 E. MATTITUCK	60	74-10-18	9.9	60	100	26	8.4	23	3.2	53
S 53325 MATTITUCK	66	74-11-11	9.8	120	100	74	15	16	4.3	170
S 53326 OREGON	89	74-10-22	11	140	120	41	13	15	3.0	110
S 53327 CUTCHOGUE	42	74-10-10	7.7	80	100	43	8.6	8.7	3.8	70
S 53328 BAYVIEW	39	74-11-13	8.8	30	60	22	3.7	5.5	3.2	62
S 53329 E. CUTCHOGUE	71	75-02-04	11	130	50	70	20	13	2.2	200
S 53330 E. MARION	51	75-01-08	12	20	100	24	8.9	18	3.0	61
S 53331 E. MARION	68	74-12-09	12	190	50	5.0	4.5	17	2	13
S 53332 MATTITUCK	43	74-10-03	6.4	0	10	14	1.5	8.0	3.2	28
S 53333 MATTITUCK	72	74-10-31	9.0	50	--	40	5.2	10	3.2	83
S 53334 E. MATTITUCK	51	74-10-08	7.4	70	90	26	4.7	5.6	2.4	65
S 53335 SOUTHOLD	35	74-11-15	7.1	50	60	76	14	--	11	180
S 53336 E. MATTITUCK	40	74-11-04	6.9	30	30	31	4.9	21	6.6	75
S 53337 ORIENT	50	75-03-11	16	250	70	48	27	28	2.6	140
S 53338 SOUTHOLD	63	74-11-22	9.0	630	50	55	8.8	20	6.8	110
S 53339 GREENPORT	35	74-12-20	7.6	180	70	17	2.8	10	1.0	38

DATE OF SAMPLE	CHLORIDE (CL) (MG/L)	NITRATE (N) (MG/L)	NITROGEN (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	DISSOLVED OXYGEN (MG/L)	TOTAL ORGANIC CARBON (C) (MG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
73-04-10	23	6.0	6.0	.02	.01	191	330	6.4	10.5	5.4	--	.08
73-04-04	680	1.7	5.8	3.1	.08	1248	2200	6.5	10.5	4.5	--	.12
74-11-06	22	5.5	5.6	.01	--	192	370	6.2	11.5	8.5	5.5	.10
74-11-27	32	5.7	5.8	.01	--	174	296	5.8	12.5	5.4	3.4	.10
74-10-18	48	2.7	2.8	.01	--	202	400	5.5	12.0	9.2	2.0	.00
74-11-11	35	15	15.1	.01	--	396	810	5.8	13.0	9.3	4.2	.20
74-10-22	28	8.4	8.5	.01	--	262	520	6.0	11.0	10.0	--	.10
74-10-10	21	14	14.2	.01	--	228	435	5.5	12.0	7.5	2.2	.11
74-11-13	8.3	.84	.93	.06	--	119	235	5.4	12.0	8.2	8.3	.00
75-02-04	32	15	15.2	.04	--	420	715	--	11.0	7.2	4.8	.10
75-01-08	26	10	10.2	.16	--	205	420	6.1	12.5	8.8	2.3	.10
74-12-09	32	.14	.2	.01	--	91	225	6.0	12.0	11.0	2.2	.00
74-10-03	11	3.2	3.2	.02	--	89	160	5.9	11.0	7.7	4.8	.05
74-10-31	20	6.0	6.1	.00	--	203	400	6.1	11.0	10.8	6.0	.01
74-10-08	12	6.5	6.6	.01	--	138	285	6.0	11.5	9.1	2.8	.07
74-11-15	39	18	18.1	.03	--	427	910	5.4	12.0	9.0	6.1	.20
74-11-04	32	6.9	7.0	.00	--	212	460	5.9	12.0	8.1	2.9	.10
75-03-11	68	8.0	8.1	.03	--	375	618	6.3	11.5	7.1	3.0	.10
74-11-22	32	12	--	--	--	301	645	5.8	12.0	8.7	7.2	.20
74-12-20	14	1.7	1.9	.00	--	102	260	6.0	13.5	9.1	2.7	.00

Metals

Group 1

Arsenic (As)

Arsenic was found in 54 samples in concentrations ranging from less than 1 µg/L to 20 µg/L; 48 of the samples contained less than 2 µg/L. Maximum concentration allowed by PHS (1962, p. 7) for this toxic metal is 10 µg/L (EPA, 50 µg/L). Six of the observation wells in the following townships showed above-normal arsenic concentrations; these are Babylon well S43821, 5 µg/L; Brookhaven wells S47745 and S47945, 10 µg/L each, and well S47748, 20 µg/L; and Southampton wells S48425 and S48427, 10 µg/L each. Arsenic concentrations ranging from 1 to 2 µg/L were detected in 12 wells that ranged from 450 feet to 1,921 ft in a previous study in Suffolk County (Harr, 1973, p. 16). These concentrations are considered by the author to be of normal background levels, and arsenic concentrations up to several µg/L probably occur naturally throughout the county.

Arsenic can be added to the ground water through industrial-waste disposal and use of insecticides and herbicides containing arsenic.

Barium (Ba)

Barium was detected in 37 samples in concentrations ranging from 90 to 400 µg/L, but most contained less than 200 µg/L. Maximum concentration allowed by PHS (1962, p. 8) is 1,000 µg/L (EPA, 1,000 µg/L). According to Harr (1973, p. 16), barium was not detected in a survey of 18 Suffolk County wells ranging in depth from 88 to 1,921 ft. It is therefore probable that barium in the ground water of Suffolk County results mostly from surface disposal of materials containing barium.

Cadmium (Cd)

Cadmium was detected in 11 samples in very low concentrations (1 µg/L each). Maximum concentration allowed by PHS (1962, p. 8) is 10 µg/L (EPA, 10 µg/L). The presence of cadmium is attributed mostly to surface disposal or leakage of industrial wastes; Perlmutter and Lieber (1970) describe such contamination by plating wastes in Nassau County. Observation wells in the townships in which cadmium was detected are Babylon wells S43808, S43809, and S43814; Islip well S45446; Riverhead wells S51566 and S51589; Southampton wells S48436, S48442, and S51184; and Southold wells S53329 and S53335 (plate 1A). The latter seven wells are in suburban and rural areas in the eastern part of the country. No cadmium was reported by Harr (1973, p. 16) in a survey of 18 deep wells in Suffolk County.

Chromium, hexavalent (Cr^{+6})

The maximum concentration of hexavalent chromium allowed by PHS (1962, p. 8) is 50 µg/L (EPA, 50 µg/L). Hexavalent chromium was detected in 38 samples in concentrations ranging from less than 2 µg/L to less than 40 µg/L; half the samples had concentrations of less than 10 µg/L, about one-third had 10 µg/L, and about one-sixth had more than 10 µg/L. Observation wells

in the following townships in which concentrations were 10 µg/L or more are Babylon well S43808; East Hampton well S48518; Riverhead wells S47226, S47228, S51571, S51577, S51578, S51582, S51591, and S52449; Shelter Island wells S51173 and S51179; Smithtown well S47157; Southampton wells S47232, S48430, S48439, S48441, and S48582; and Southold well S53338 (plate 1A). Most of these wells are in the eastern part of the county, and many of the highest concentrations were in parks and farmed areas. Chromium, like cadmium, is believed to seep into ground water largely from surface disposal or leakage of industrial wastes; Perlmutter and Lieber (1970) describe chromium contamination of ground water by plating wastes in Nassau County. No chromium was found in a survey of 18 deep wells in Suffolk County (Harr, 1973, p. 16).

Copper (Cu)

Copper was detected in 187 analyses in concentrations ranging from 0 to 50 µg/L; the average concentration of copper was 3.5 µg/L. Because the maximum concentration of copper allowed by PHS (1962, p. 7) is 1,000 µg/L (EPA, copper deleted from standards), the levels found in the observation wells are considered low. Copper analyses of water from a survey of 18 deep wells in Suffolk County ranged from 0 to 190 µg/L and averaged 21 µg/L (Harr, 1973, p. 16).

Iron (Fe)

Iron was present in all samples; many had high to excessive concentrations ranging from more than 200 µg/L to more than 300 µg/L. Iron minerals are common in all aquifers of Long Island. Iron in the shallow ground water can have local sources in leachates from such installations as cesspools, sanitary landfills, and salvage yards (junkyards). Although large concentrations of iron in ground water are not toxic, the maximum concentration allowed by PHS (1962, p. 7) is 300 µg/L (EPA, iron deleted from standards). Iron in greater concentrations causes water as well as beverages and foods prepared with it to have an unpleasant taste, causes staining of utensils, fixtures, and clothing, and causes deposits to form in pipes carrying the water. Iron analyses of samples from the observation wells are given in table 2.

Lead (Pb)

Lead was detected in 125 samples in concentrations ranging from 1 to 48 µg/L. Maximum concentration allowed by PHS (1962, p. 8) for this toxic metal is 50 µg/L (EPA, 50 µg/L). Only one sample showed a concentration as high as 48 µg/L; the next highest concentration was 6 µg/L, and most were less than 3 µg/L. Lead was detected in samples from 11 of 18 deep wells in Suffolk County (Harr, 1973, p. 17). The highest concentration in that survey was 68 µg/L, and half were 5 µg/L or more. It is probable that lead concentrations to about 5 µg/L are the natural background level for Suffolk County's ground water; significantly higher concentrations may indicate contamination. The highest concentration (48 µg/L) found in this study was from well S48433 in a farming area in Deerfield, Town of Southampton (plate 1A).

Manganese (Mn)

Manganese was found in most of the samples; many exceeded the PHS (1962, p. 8) maximum allowable concentration of 50 µg/L (EPA, manganese deleted from standards). In concentrations greater than 50 µg/L, manganese is undesirable for the same reasons as iron. Manganese is a common constituent of ground water on Long Island, and its origins are similar to those of iron. Manganese concentrations in water from the observation wells are given in table 2.

Mercury (Hg)

Mercury analyses were made only on samples from the Town of Babylon. Water from the other wells could not be analyzed for mercury because the samples had been prepared improperly. However, the analyses showed only traces of mercury (less than 0.5 µg/L). Samples taken from 60 wells ranging in depth from 28 to 1,921 ft in a previous study in Nassau and Suffolk Counties also showed only traces (less than 0.5 µg/L) with one exception, which showed a concentration of 0.5 µg/L (Harr, 1973, p. 17); these concentrations are probably typical for most of Suffolk County. Maximum concentration allowed by EPA for this metal is 2 µg/L.

Silver (Ag)

Silver was detected in only 6 samples; concentrations were all 1 µg/L. Maximum concentration allowed by PHS (1962, p. 8) is 50 µg/L (EPA, 50 µg/L). No silver was detected in 18 deep wells in Suffolk County (Harr, 1973, p. 17); thus, silver is considered to be present in Suffolk County ground water in trace amounts only.

Zinc (Zn)

Zinc was found in 167 samples in concentrations ranging from 0 to 910 µg/L. Because the maximum concentration allowed by PHS (1962, p. 7) is 5,000 µg/L (EPA, zinc deleted from standards), the highest concentration of zinc detected in the analyses from the observation wells is considered to be low.

Group 2

The metals for which neither PHS nor EPA have established maximum allowable concentrations in drinking water are included in this group; they are aluminum, beryllium, lithium, and the heavy metals, cobalt, molybdenum, nickel, rubidium, strontium, tin, vanadium, and zirconium. Their concentrations in water from the observation wells are summarized in table 3, except for rubidium, tin, and zirconium, which were not analyzed. Table 3 also presents the concentrations of these metals in water from deep wells in Suffolk County in a previous study for comparison.

Table 3.--Concentrations of selected metals[1/] in samples from observation wells screened near water table compared with those from deep wells, Suffolk County, N.Y., 1972-75.

[Concentrations are in micrograms per liter]

Metal	Number of analyses	Shallow observation wells			18 deep wells in Suffolk County[2/]		
		Number of detections	Highest concentration	Average concentration	Number of detections	Highest concentration	Average concentration
Aluminum (Al)	187	77	1,000	64	5	500	61
Beryllium (Be)	139	0	--	--	[3/]	--	--
Cobalt (Co)	187	48	5.0	.75	5	2.0	.33
Lithium (Li)	187	5	10	.41	1	30	1.7
Molybdenum (Mo)	186	57	65	2.1	14	26	7.7
Nickel (Ni)	186	130	42	4.1	15	4.0	1.9
Strontium (Sr)	182	157	520	83	5	70	11
Vanadium (V)	171	13	4.4	.13	[4/]11	3.3	.70

1/ No recommended maximum allowable concentration given by U.S. Public Health Service or U.S. Environmental Protection Agency.
2/ From Harr, 1973, p. 16-17.
3/ No analyses made.
4/ 16 analyses made.

The average concentrations in the deep wells are considered to represent normal background levels for the county. Accordingly, the average amounts of nickel and strontium from the observation wells (table 3) seem to be significantly higher than background levels and tend to occur mostly in the eastern part of the county, predominantly in agricultural areas. The effects of these metals on human physiology are not adequately known, with the exception of strontium-90, a radioactive isotope that is highly undesirable in drinking or irrigation water because it can be injurious or fatal to humans and animals. Radioactivity of the ground water is described in a separate section.

Nonmetallic Substances and Miscellaneous Constituents and Properties

Nonmetallic substances and miscellaneous constituents and properties are separated into two groups for convenience in this report, as were the heavy metals. Group 1 contains substances for which PHS and (or) EPA has established maximum allowable concentrations; group 2 contains those for which no limits have been adopted by the PHS or EPA but are of general interest to water users.

Group 1

Chloride (Cl^-)

Chloride imparts a salty taste to water and is detectable by most people in concentrations greater than 250 mg/L. Maximum concentration recommended by PHS (1962, p. 34) for drinking water is 250 mg/L (EPA, chloride deleted from standards). In undeveloped areas of Suffolk County, chloride in shallow ground water is generally less than 10 mg/L. Addition of chloride to ground water is usually the result of human activities such as discharge of sewage effluent, use of salt to melt ice and snow on roads, and overpumping of aquifers, which draws saline ground water landward from shorelines. Wells near shorelines are especially likely to yield water having high chloride concentrations. Chloride in 183 samples of water from the observation wells ranged from 2.5 to 68 mg/L and averaged 14 mg/L in the Town of Huntington and 28 mg/L in the Town of Southold. In four samples, chloride ranged from 98 to 1,000 mg/L. Two of these wells are near shorelines (well S47234, 680 mg/L; well S51184, 300 mg/L); one is in artificial fill near a storm-water recharge basin (well S47157, 1,000 mg/L); and one (well S47749, 98 mg/L) is probably in large part affected by sewage and road salts. Chloride analyses of water from the observation wells are given in table 2.

Cyanide (CN^-)

Cyanide usually originates from industrial wastes. Maximum concentration allowed by PHS (1962, p. 8) is 0.2 mg/L (EPA, 0.2 mg/L). Cyanide analyses were made on samples from 15 observation wells in the Town of Babylon, one of the more industrialized areas in Suffolk County; 14 samples showed no cyanide, and one had a concentration of only 0.01 mg/L.

Fluoride (F^-)

Fluoride in drinking water can prevent dental caries, but excessive amounts can produce mottling of teeth and (or) serious bone damage. Maximum concentration allowed by PHS (1962, p. 8) for drinking water ranges from 1.7 mg/L (EPA, 2.4 mg/L), at annual average maximum daily air temperatures of 50 to 54°F, to 0.6 mg/L (EPA, 1.4 mg/L) at the corresponding temperatures of 79 to 91°F. Fluoride was found in 170 samples in concentrations ranging from 0 to 0.6 mg/L; the three highest concentrations, 0.4, 0.5, and 0.6 mg/L, were found in the Towns of East Hampton and Southold, Southampton, and Riverhead, respectively. In the remaining towns, highest concentrations ranged from 0.1 to 0.3 mg/L.

Nitrate Nitrogen (NO_3^- as N)

The PHS (1962, p. 7) set a limit of 10 mg/L (EPA, 10 mg/L) for nitrate nitrogen, or nitrate measured as nitrogen (N) because greater nitrate concentrations in drinking water can be harmful or fatal to infants in the first few months of life. The main sources of nitrate in the ground water of Suffolk County are sewage discharged to the ground and leachates from fertilizers. In undeveloped areas of Suffolk County, concentrations of nitrate nitrogen in water from the observation wells ranged from 0 to 0.5 mg/L; in large parts of developed areas, nitrate-nitrogen concentrations ranged from several mg/L to as much as 18 mg/L. Because contamination of ground water by nitrate is of great concern in the county, the areal distribution of nitrate nitrogen in shallow ground water is shown in a map of the county (pl. 1C). In western Suffolk County, the major source of nitrate is sewage draining from cesspools and other ground-disposal sewage systems; in the eastern part, it is agricultural fertilizers. Nitrate-nitrogen concentrations determined in water from the observation wells are given in table 2.

Pesticides

Pesticides (insecticides and herbicides) are used on crops, in parks and golf courses, and on lawns, trees, and shrubbery to control or elimate insects and weeds or other undersirable plants. It is assumed that large amounts of these substances have been used for several decades, and these toxic compounds could contaminate the ground water. Consequently, water samples from 180 of the observation wells were selectively analyzed for the following pesticides:

Insecticides			Herbicides
Aldrin	dieldrin	malathion	2, 4-D
Chlordane	endrin	methyl-parathion	Silvex
DDD	ethion	methyl-trithion	
DDE	heptachlor	parathion	
DDT	heptachlor	toxaphene	
Diazion	lindane		

Insecticide residues consisting of one or more of the following: DDD, DDE, DDT, diazinon, and dieldrin were detected in samples from 15 of the 180 observation wells. The amounts detected ranged from unmeasurable traces to very small amounts, mostly less than several hundredths of a µg/L; these data are shown in table 4.

Herbicide residues in trace amounts of less than 0.1 µg/L were detected in 9 of the 180 samples; these data are shown in table 5.

Phenols

The PHS (1962, p. 51) set a limit of 1 µg/L for phenols in drinking water (EPA, phenols deleted from standards) because chlorination of water containing even extremely low phenol concentrations imparts an undersirable taste. Phenol concentrations in samples ranged from 0 to 19 µg/L; however, most of the wells showed no phenols. Average phenol concentrations in the townships of the county ranged from less than 1 µg/L to 5

Table 4.--Concentrations of insecticides in samples from shallow observation wells, Suffolk County, N.Y., 1972-75

[Concentrations are in micrograms per liter]

Town	Well number	Insecticides				
		DDD[1/]	DDE[1/]	DDT[1/]	Diazinon[1/]	Dieldrin[1/]
Babylon	S43808	---	---	---	---	0.01
Brookhaven	S46912	---	0.01	0.02	---	.09
Do.	S46913	0.04	.02	.08	---	.11
East Hampton	S47235	trace	trace	---	---	---
Riverhead	S51575	8.1	---	---	---	---
Do.	S51583	---	---	---	---	.01
Southold	S53333	---	---	---	trace	---

1/ No maximum-allowable concentration criteria for drinking water given by U.S. Public Health Service (1962) or U.S. Environmental Protection Agency (1975a and 1975b).

NOTE: Dashes indicate insecticide was not detected or looked for.

µg/L; however, median values of phenols were 0 in all towns except East Hampton, which showed a median concentration of 1 µg/L. The source of phenol contamination may be derived from industrial wastes (cresols and xylenols), but the highest phenol concentrations were found in parks and agricultural areas as well as in built-up areas. Phenol concentrations as high as 26 µg/L in deep wells in the county are shown in Harr (1973), p. 17). It is probable that phenols originate from natural processes as well as from industrial activities because they occur in water from the deep wells as well as shallow wells in undeveloped areas.

Table 5.--Concentrations of herbicides in samples from shallow observation wells, Suffolk County, N.Y., 1972-75

[Concentrations are in micrograms per liter]

Town	Well number	Herbicides	
		Silvex[1/]	2, 4-D[2/]
Babylon	S43819	0.01	---
Brookhaven	S47974	---	trace
Do.	S47977	---	0.07
Do.	S48425	---	trace
Islip	S47222	trace	---
Riverhead	S47230	trace	---
Smithtown	S46963	---	trace
Southampton	S47230	trace	---
Southold	S46963	---	trace

1/ No maximum-allowable concentration for drinking water given by U.S. Public Health Service (1962); U.S. Environmental Protection Agency (1975a) gives maximum of 10 µg/L.

2/ No maximum-allowable concentration for drinking water given by U.S. Public Health Service (1962); U.S. Environmental Protection Agency (1975a) gives maximum of 100 µg/L.

NOTE: Dashes indicate herbicide was not detected or looked for.

Selenium (Se)

Selenium was detected in 83 samples in concentrations ranging from less than 1 µg/L to 17 µg/L. In 81 of the analyses, concentrations ranged from 1 to 4 µg/L but were mostly less than 2 µg/L. Maximum concentration allowed by PHS (1962, p. 8) for this toxic element is 10 µg/L (EPA, 10 µg/L). Two wells in the Town of Huntington, S45053 and S45207 (plate 1B) showed excessive selenium concentrations of 17 and 13 µg/L, respectively. It is probable that selenium concentrations as high as 2 µg/L are normal for native ground water in Suffolk County. The cause of the excessive concentrations at Huntington is not known but is assumed to be from the surface. Eight samples from deep wells in Suffolk County (Harr, 1973, p. 17) showed concentrations ranging 1 to 5 µg/L; concentrations in seven of those samples did not exceed 2 µg/L.

Sulfate (SO_4^{-2})

Large amounts of sulfate in water are undesirable because they may impair taste and have a laxative effect. Maximum concentrations allowed by PHS (1962, p. 34) are 250 mg/L if other suitable supplies are available (EPA, sulfate deleted from standards). None of the samples exceeded 200 mg/L, and most sulfate concentrations were less than 20 mg/L. Sulfate concentrations were highest in central and eastern Suffolk County, particularly in the Towns of Riverhead and Southold, where use of agricultural fertilizers may be the source. Sulfate analyses of water from the observation wells are given in table 2.

Synthetic Detergents (MBAS)

Synthetic detergents, commonly called MBAS (methylene-blue active substances), are undesirable in drinking water because they impair the taste and cause foaming (sudsing). MBAS in the ground water of Suffolk County originates mostly from washing detergents that are discharged to the ground water through cesspools. Maximum concentration allowed by PHS (1962, p. 24) is 0.5 mg/L (EPA, MBAS deleted from standards). MBAS were detected in 184 samples mostly in concentrations (up to 0.15 mg/L). Lowest concentrations, usually less than 0.05 mg/L, occurred in the Towns of Brookhaven, East Hampton, Shelter Island, and Southampton. Only in Babylon were relatively high concentrations found in a significant number of observation wells (6 of 14); five were moderate, 0.18 to 0.35 mg/L, and one, from well S43813, was excessive (0.64 mg/L). Perlmutter and Guerrera (1970) reported general contamination of the upper glacial aquifer by MBAS in Babylon in the mid-1960's, and Baier (1976) described MBAS contamination in Babylon and Islip in the early 1970's. MBAS concentrations in water from the observation wells are given in table 2.

Although MBAS, like nitrate, is an indicator of contamination from sewage effluent, MBAS contamination is not as widespread as nitrate contamination in Suffolk County. The lesser degree of MBAS contamination is probably due in great part to the county's ban on the sale of laundry (but not automatic-dishwasher) detergents containing MBAS since March 1971 (Baier, 1976, p. 6).

Dissolved Solids

Large amounts of dissolved solids in drinking water impair its flavor and may have a laxative effect. Maximum concentration allowed by PHS (1962, p. 34) is 500 mg/L if other suitable supplies are available (dissolved solids deleted from EPA standards). Large amounts of dissolved solids in water are also undesirable because they deposit scale in boiler components, hot-water pipes, and cooking utensils. Dissolved-solids concentrations in all samples ranged from 21 to 1,800 mg/L and averaged less than 100 mg/L except in the Towns of Babylon and Riverhead. There, they averaged 179 and 177 mg/L and are attributed mainly to contamination from cesspools, septic tanks, landfills, and agricultural fertilizers. Two extremely high concentrations of dissolved solids, 1,248 and 1,800 mg/L, in Southold and Smithtown, respectively, are considered to be anomalous. Well S47234 in Southold taps salty water near a shoreline; well S47157 in Smithtown is in artificial fill at a storm-water recharge basin. Dissolved-solids concentrations in water from the observation wells are given in table 2.

Group 2

Items in this group include ammonia, boron, organic industrial wastes, hardness, specific conductance, pH, and temperature.

Ammonia (NH_3)

The presence of ammonia in the ground water of Suffolk County is an indication of contamination by organic wastes, chiefly from cesspools, septic tanks, and landfill effluents. Ammonia concentrations in samples from the six towns east of Brookhaven ranged from 0 to 0.54 mg/L, and median concentrations ranged from 0.01 to 0.04 mg/L. In the four towns west of Brookhaven, ammonia concentrations ranged from 0.01 to 0.58 mg/L. The highest ammonia concentrations in the county were in samples from Babylon (median, 0.58 mg/L), and the second highest were in Islip (median, 0.08 mg/L). The median concentration of 0.40 mg/L from six wells in Smithtown was considered unrealistic because it included an anomalous sample containing 5.4 mg/L from a well in artificial fill at a storm-water recharge basin (S47157); if this anomalous value is discounted, the median ammonia concentration for the town becomes 0.05 mg/L. Ammonia has been detected in precipitation (Hem, 1970, p. 49), and concentrations as high as 0.05 mg/L seem to be normal background levels in Suffolk County. However, concentrations significantly greater than 0.05 mg/L probably indicate contamination from sewage. Ammonia concentrations in water from the observation wells are given in table 2.

Boron (B)

Boron (a metalloid element) was detected in 159 of the samples. The highest concentration was 670 µg/L, and the average concentration was 80 µg/L. In 16 samples from deep wells in Suffolk County (Harr, 1973, p. 16-17), the highest concentration was 80 µg/L, and the average concentration was 32 µg/L.

Accordingly, it seems that many boron concentrations are higher than background level. Most of the higher boron concentrations were in the eastern part of the county in predominantly agricultural areas, where the sources are probably fertilizers and (or) pesticides.

Organic Industrial Wastes

PCB's (polychlorinated biphenyls).--In three samples, PCB's were found only in trace amounts of less than 0.01 µg/L. The townships and wells of these occurrences are Babylon, S43815; Brookhaven, S48946; and Huntington S45208.

PCN's (polychlorinated naphthalenes).--No PCN's were found in 37 samples from the Towns of Riverhead and Southold.

Hardness

Hardness in water results mainly from calcium and magnesium ions. Hardness is apparent when soap does not lather. Although calculated hardness is not given in table 2, the hardness of water samples listed in this report can be estimated from table 2 by adding the calcium and magnesium concentrations and applying the total to the following guide:

Calcium plus magnesium (mg/L)	Approximate hardness	Hardness standards, as calcium carbonate (mg/L)
less than 20	soft	0-60
20 to 40	moderately hard	61-120
41 to 60	hard	121-180
more than 60	very hard	more than 180

In undeveloped areas of Suffolk County away from shorelines, ground water is soft. Where excessive ground-water hardness occurs in the county, it results from contamination by sewage and (or) agricultural fertilizers. Near shorelines, hardness can result from saltwater infiltration into the aquifer.

Specific Conductance

Pure water is a poor conductor of electricity. Thus, specific conductance of water, measured in micromhos per centimeter at 25°C, is directly related to dissolved solids. In Suffolk County, shallow ground water that is not contaminated or located near the shorelines has a low specific conductance, generally less than 50. Specific conductances of water samples from the observation wells is given in table 2.

pH

The pH of water is a measure of its acidity or alkalinity. The pH scale ranges from 0 to 14, with 7 neutral. pH values lower than 7 indicate the water to be acidic, those greater than 7 alkaline. The PHS (1962, p. 7) set no standards for pH limits in drinking water other than that water "...should not be excessively corrosive to the water supply system..." (EPA, no pH standards). Water from the observation wells was generally acidic; very few samples had a pH of more than 7. When the pH of water is lower than about 6.5, the water can be corrosive to plumbing. The pH values of water from the observation wells are given in table 2.

Temperature

The temperature of shallow ground water under natural conditions according to Collins, (1925, p. 98) is nearly the same as the mean annual temperature, which in Suffolk County has ranged from about 49° to 52°F (Mordoff, 1949, p. 39-41). Water temperature is important where the water is to be used for refrigeration or cooling processes. Temperatures of water from the observation wells ranged between 6° and 14.5°C, a range considered normal for the periods during which the samples were collected.

Radioactivity of Ground Water

Analyses for radioactivity were made in water samples from 109 of the observations wells. Samples were analyzed for gross alpha and beta radiation only. Gross-alpha counts range from 0.10 to 7.3 pCi/L (pico-curies per liter); the 7.3 count was obtained from the previously mentioned well S47157, in the Town of Smithtown, which is in artificial fill at a storm-water recharge basin and which gave anomalously high readings for other constituents. The second highest gross-alpha count was considerably less, 4.3 pCi/L. The average gross-beta counts over the county ranged from less than 0.4 pCi/L to 14 pCi/L and averaged about 3 pCi/L.

The standards for maximum allowable radioactivity in water are being revised to include factors such as isotope type and length of exposure. According to Paul Giardina, EPA New York, N.Y. (oral commun., Feb. 20, 1976), no general standards have as yet been established, but if drinking water has a gross-alpha count of less than 15 pCi/L, a gross-beta count of less than 50 pCi/L, and a strontium-90 count of less than 2 pCi/L, the water is acceptable. No strontium-90 analyses were made on samples from the observation wells. However, much of the gross-beta radiation is from potassium-40 (included in the potassium analyses, table 3) and sources other than strontium-90. The only known instances of significantly elevated strontium-90 levels in the ground water of Suffolk County have occurred only in a small area within the grounds of the Brookhaven National Laboratory (Hull and Ash, 1975, table 21 and p. 34). Ground-water radioactivity within the laboratory area is constantly monitored by laboratory personnel and, as late as 1974, ground-water radioactivity at the periphery of the area was at or near natural background levels (Hull and Ash, 1975, p. 13).

Radioactivity in ground water throughout the rest of Suffolk County seems to be at natural background level.

SUMMARY

Observation wells screened near the water table in the upper glacial aquifer were installed at 171 sites in Suffolk County, N.Y., from 1972 to 1975, to determine the areal extent and degree of man-made contamination of the shallow ground water, and for use in monitoring water quality in the future. A sample of water was pumped from each well and analyzed for general chemical quality, heavy metals, pesticides, and radioactivity.

The shallow ground water showed widespread contamination, chiefly by nitrates. Moderate to excessive concentrations of nitrate nitrogen (more than 3 to more than 10 mg/L) were found, mostly in the Towns of Babylon, Brookhaven, Huntington, Islip, Riverhead, and Southold; concentrations were generally lower in the remainder of the county. In the more densely and longer populated, western part of the county, the source of nitrates seems to be chiefly from sewage disposal to the ground; in the less populated and rural eastern parts, the source is chiefly leachates from agricultural fertilizers.

Significant contamination of the shallow ground water by MBAS from cesspool effluents was observed in much of Suffolk County, but mostly in low concentrations (up to 0.15 mg/L). Moderate to excessive concentrations of MBAS (more than 0.15 to 0.5 mg/L) were found to be almost exclusively in the Town of Babylon. The lowest MBAS concentrations (generally less than 0.05 mg/L) were in the Towns of Brookhaven, East Hampton, Shelter Island, and Southampton. The low degree of MBAS contamination relative to nitrate contamination is probably in part a result of the ban on the sale of laundry (but not automatic-dishwater) detergents in the county since March 1971.

Of the metals in the shallow ground water of Suffolk County, high concentrations of iron and manganese (more than 200 µg/L and 30 µg/L, respectively) were widespread and, in some areas, excessive according to recommended standards of the U.S. Public Health Service (1962) (iron, more than 300 µg/L; manganese 50 µg/L). However, iron and manganese are not considered harmful to human health, and EPA standards do not include these metals.

Heavy metals other than iron and manganese that were found in significant concentrations include cadmium and hexavalent chromium--toxic metals for which maximum concentrations recommmended by PHS and EPA in drinking water are 10 and 50 µg/L, respectively. Nickel and strontium, for which no standards have been published by the Public Health Service (1962) or Environmental Protection Agency (1975a and 1975b), were also found in significant concentrations at several locations.

Cadmium was detected in 11 of the samples (about 6 percent) from widely separated areas of the county and in very low concentrations (1 µg/L). Hexavalent chromium was detected in 38 of the samples (about 20 percent), also from widely separated areas; chromium concentrations at half these wells exceeded 10 µg/L and was nearly 40 µg/L at one of them. The highest chromium concentrations occurred in wells in the rural, eastern parts of Suffolk County.

Generally low but locally significant concentrations of boron and selenium were found in water from the observation wells throughout the county. Boron was detected in 159 of the wells (82 percent) in concentrations ranging to as much as 670 µg/L. Boron concentrations tended to be higher in the eastern part of the county. No standards of maximum allowable concentrations of boron in drinking water were adopted by the Public Health Service (1962) or Environmental Protection Agency (1975a and 1975b). Selenium was detected in 83 of the samples (about 43 percent), mostly in low concentrations (less than 2 µg/L). Two wells in the Town of Huntington yielded excessive selenium (more than 10 µg/L) of unknown but assumed surficial origin.

Contamination of the shallow ground water of Suffolk County by insecticides and herbicides is rare and of insignificant magnitude where present. Because commercial agriculture is extensive in eastern Suffolk, it must be assumed that large amounts of pesticides have been used there for many decades, yet pesticide residues were detected in only a few samples from widely separated localities, and only in traces or very minute concentrations. Pesticides seem to be mainly held in the upper soil zone and (or) to degrade into simpler compounds.

No significant contamination of the shallow ground water of Suffolk County by radioactivity was detected in observation-well samples. Except for a small area within the grounds of the Brookhaven National Laboratory, radioactivity in the county's ground water does not exceed background levels. Gross-alpha counts from the samples ranged from 0.10 to 4.3 pCi/L and averaged less than 1 pCi/L; gross-beta counts ranged from less than 0.4 pCi/L to 14 pCi/L and averaged 3 pCi/L. Strontium-90 analyses of the water were not made, but the magnitude of the alpha and beta counts and presence of potassium-40 (which occurs naturally with potassium) and other naturally occurring radioactive isotopes suggest that strontium-90 concentrations are within allowable amounts. However, strontium-90 analyses would be necessary at selected localities in the county to substantiate occurrences of these low levels.

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